QP Code : **16600**

(2½ Hours) [Total Marks :60

N.B. : (1) **All** questions are **compulsory.**
(2) Use of log table or non-programmable **calculator** is permitted.

1. (a) Attempt any **two** of the following:— **8**
(i) Describe the different vibrational modes of CO_2. Which vibrations are infrared active?
(ii) Explain the basic principle of FTNMR.
(iii) Give the significance of group frequency region in IR spectroscopy.
(iv) What are chemical shifts? How are they applicable in qualitative analysis of the molecules?
(b) Discuss the applications of NMR spectroscopy with respect to phosphorous^{31}. **4**

OR

(b) How will you correlate the dipole moment of the molecule with the absorption of IR radiations by it? **4**

2. (a) Attempt any **two** of the following:— **8**
(i) Explain the dispersing Raman spectrometer with the help of a schematic diagram.
(ii) What are the applications of mass spectroscopy?
(iii) Discuss the mechanism of Rayleigh scattering.
(iv) Give an account of metastable peaks obtained in mass spectroscopy.
(b) Explain the sample handling of liquids in Raman spectroscopy. What are its advantages over sample handling in IR spectroscopy? **4**

OR

(b) At what wavelength the lines with Raman shift 314 and 516 cm^{-1} would appear if irradiated with radiation of wavelength of 440 nm? **4**

3. (a) Attempt any **two** of the following:— **8**
(i) Give the applications of differential thermal analysis.
(ii) Describe the heat flux DSC cell with a schematic diagram.
(iii) Explain the instrumentation used in γ radiography.
(iv) What are the basic factors that affect the induced radioactivity during NAA?
(b) The penicillin in a mixture was determined by adding 0.981 mg of labelled compound having a specific activity of 2420 cpm/mg. After equilibrium 0.406 mg of pure penicillin isolated had activity of 343 cpm. Calculate the amount of penicillin in the original sample. **4**

OR

(b) Discuss the basic principle and applications of thermometric titrations. **4**

(a) Attempt any **two** of the following:— **8**

(i) What are the difficulties in coupling IR to GC? How are they overcome?

(ii) Discuss the possible interferences in ICP-MS technique?

(iii) Explain the role of a collision cell in MS-MS technique. How can you use this technique to identify species having same mass and different structures?

(iv) Describe the principle and instrumentation of HPLC-MS.

(b) Give the applications of ICP-OES. **4**

OR

(b) What are the advantages of hyphenated techniques? **4**

Attempt any **four** of the following:— **12**

(i) What is meant by finger print region? How is it useful in qualitative analysis by IR spectroscopy?

(ii) Discuss the applications of C^{13} NMR.

(iii) What is the principle of mass spectroscopy? Give the names of the various components of a mass spectrometer.

(iv) How is qualitative analysis of organic compounds done by Raman spectroscopy?

(v) Explain how a thermogravimetric instrument can be coupled to a mass spectrometer for the analysis of gaseous products.

(vi) What is x-ray radiography? How does it differ from auto-radiography?

(vii) How is the coupling of argon plasma with the mass spectrometer carried out?

(viii) What are the requirements that the system must fulfill when a GC is to be linked with MS?
